




# Red oak group

Northern red oak, *Querqus rubra*
Black oak, *Querqus velutina*
Northern pin oak, *Querqus ellipsoidalis*

**T**he **volume in the red oak group has increased** steadily since 1983. However, there are significant differences among the species. The number of black oak and northern red oak trees has declined in almost all size classes while the number of northern pin oak has increased dramatically.

**Growth and morality rates have increased** proportionately with volume. Whereas red oak species make up about 12% of all volume of trees in Wisconsin, they account for 10% of growth and 11% of mortality.

**R**ed oaks are **important timber species**, comprising over 16% of roundwood production in 2009. Given the high density of red oak wood and the large volume of red oak in Wisconsin, it may be a valuable source of woody biomass for biofuel production.

- *How has the red oak resource changed?*
  **Growing stock volume and diameter class distribution: 1983, 1996, and 2012**
- *Where do red oaks grow in Wisconsin?*
  **Growing stock volume by region with map**
- *How fast are red oaks growing?*
  **Average annual net growth by region and year: 1983, 1996, and 2012**
- *How healthy are red oaks in Wisconsin?*
  **Average annual mortality: 1983, 1996, and 2012**
- *How much red oak do we harvest?*
  **Roundwood production by product: 1997, 2003, and 2009**
- *How much is red oak selling for?*
  **Prices for cordwood and sawtimber: 2000 to present**
- *How much red oak biomass do we have?*
  **Aboveground carbon by region of the state: 2012**

*"How has the red oak resource changed?"*

**Growing stock volume and diameter class distribution by year**

**T**he growing stock volume of red oaks in 2012 was about 2.7 billion cft or 12.4% of total statewide volume (Chart 1). This represents an increase of 31% since 1983 and 6% since 1996.

**T**he red oak resource is maturing; the total volume in small growing stock (5-13 inches dbh) has decreased by 25% since 1983 while the volume in large trees (over 13 inches dbh) has increased by 90% (Chart 2).

**T**here is a significant difference in the percentage change in tree numbers between the various species of red oaks (Chart 3). The number of northern pin oak trees has doubled. The numbers of black oak and northern red oak have decreased in all size classes.

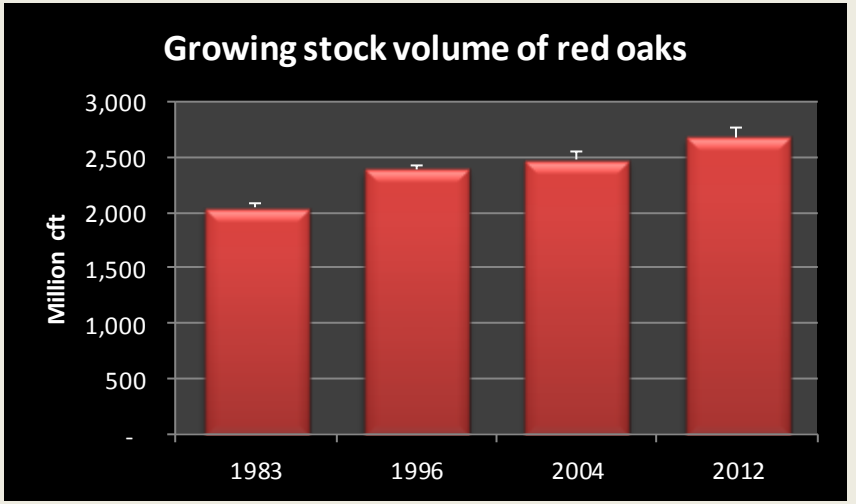



Chart 1. Growing stock volume (million cubic feet) by inventory year.
Source: USDA Forest Inventory and Analysis data: 1983, 1996, 2004 and 2012.

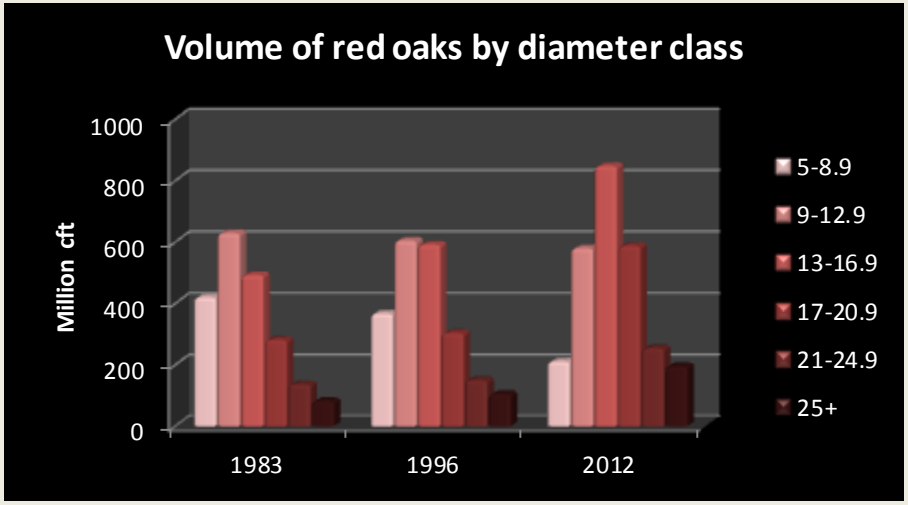



Chart 2. Growing stock volume (million cubic feet) in 1983, 1996 and 2012.
Source: USDA Forest Inventory and Analysis data: 1983, 1996 and 2012.

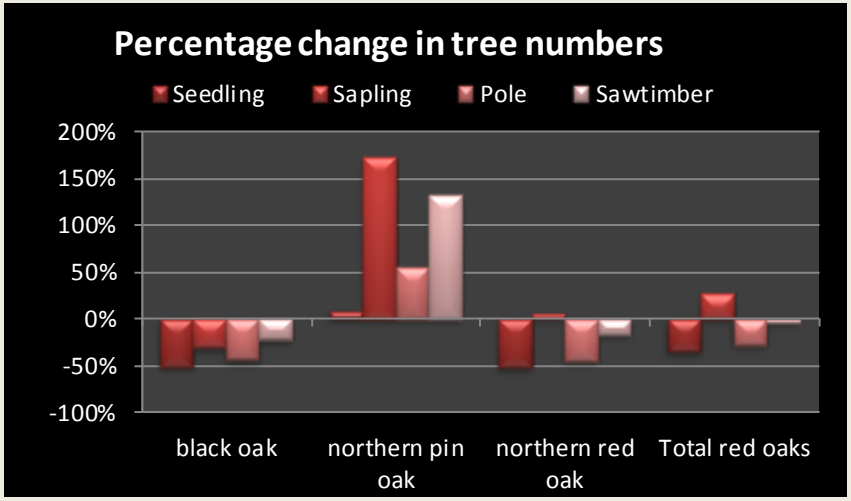
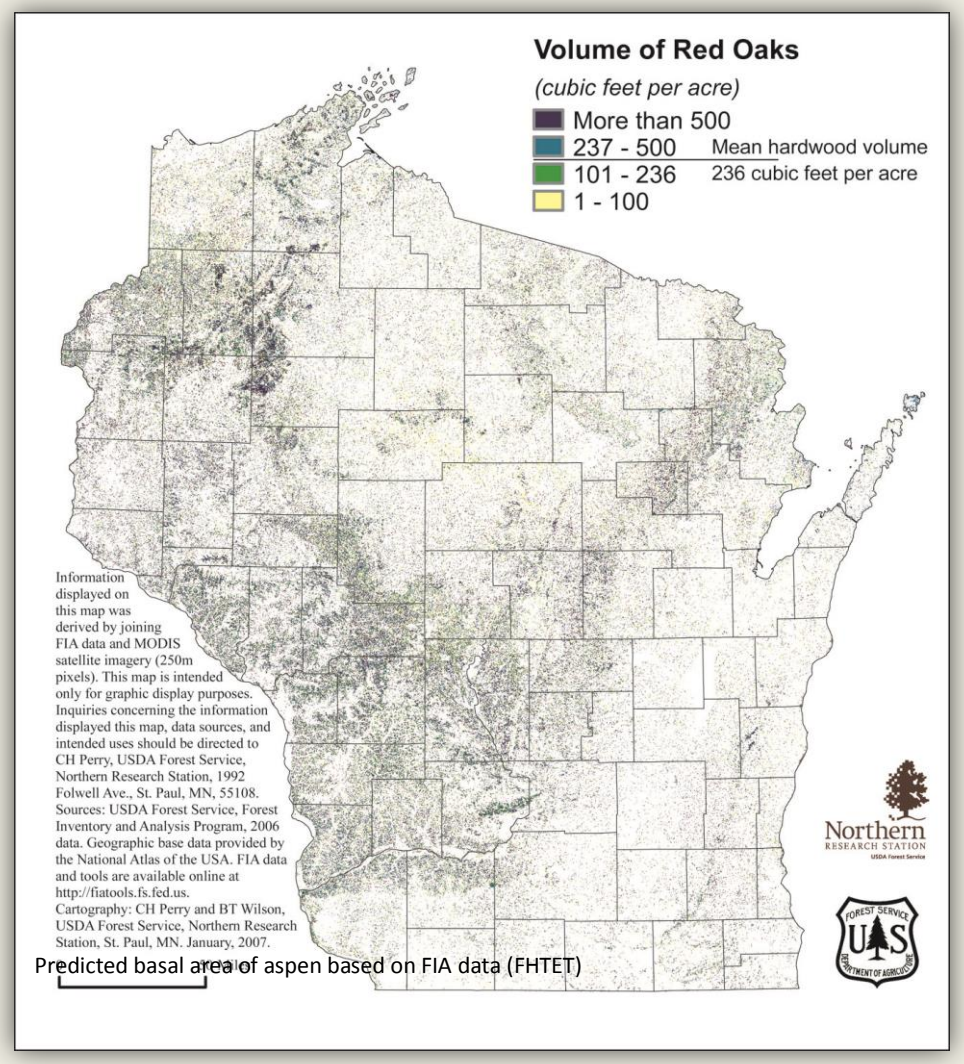



Chart 3. Percentage change in the number of live trees by size class between 1996 and 2012.
Source: USDA Forest Inventory and Analysis data 1996 and 2012.

*"Where do red oaks grow in Wisconsin?"*

**Growing stock volume by region with map**



Predicted basal area of aspen based on FIA data (FHTET)

**A**bout ⅔ of red oak volume is northern red oak which occurs throughout the state but predominately in western Wisconsin, north and south (Table 1). Northern pin oak and black oak occur mainly in the central part of the state.

**T**he vast majority of red oaks are found on the oak / hickory forest type.

Table 1. Growing stock volume (million cft) by species and region of the state.

| Species | Central | North east | North west | South east | South west | Total | Percent of total |
|---|---|---|---|---|---|---|---|
| **Black oak** | 242 | 4 | - | 36 | 88 | 371 | **14%** |
| **Northern pin oak** | 204 | 98 | 118 | 19 | 50 | 489 | **18%** |
| **Northern red oak** | 343 | 325 | 570 | 111 | 471 | 1,820 | **68%** |
| **Total red oaks** | **789** | **428** | **687** | **166** | **609** | **2,680** | **100%** |
| **Percent of total** | **29%** | **16%** | **26%** | **6%** | **23%** | **100%** | |

Source: USDA Forest Service, Forest Inventory and Analysis 2012

*For a table on* **Volume by County for 2012** go to:
http://dnr.wi.gov/topic/ForestBusinesses/documents/tables/VolumeCountySpecies.pdf

*"How fast are red oaks growing?"*

## Average annual net growth by region and year

The average annual net growth of red oaks is about 58.4 million cft/yr, representing 10.2% of statewide volume growth (Chart 4). Growth rates have increased steadily since 1983.

The highest volume growth for red oaks occurs in central Wisconsin (Table 2) but the highest growth to volume ratio occurs in the northeast and southwest parts of the state.

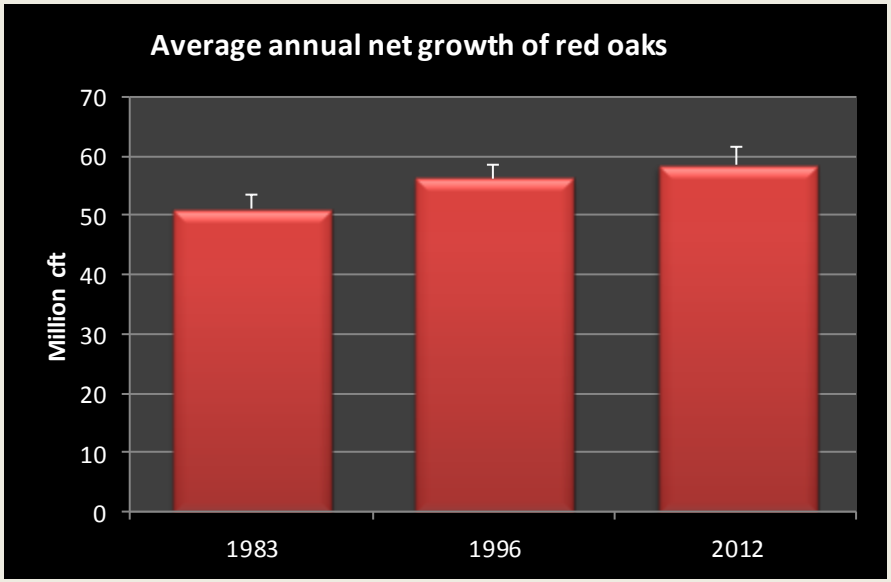



Chart 4. Average annual net growth (million cubic feet).
Source: USDA Forest Inventory & Analysis data: 1983, 1996, 2012

Table 2. Average annual net growth (million cft/year) of growing stock and the ratio of growth to volume by region of the state.

| Region | Net growth | Percent of Total | Ratio of growth to volume |
|---|---|---|---|
| **Central** | 15.7 | 27% | **2.0%** |
| **Northeast** | 10.4 | 18% | **2.4%** |
| **Northwest** | 14.5 | 25% | **2.1%** |
| **Southeast** | 3.6 | 6% | **2.1%** |
| **Southwest** | 14.2 | 24% | **2.3%** |
| **Statewide** | **58.4** | **100%** | **2.2%** |

Source: USDA Forest Inventory and Analysis 2012

The ratio of growth to volume for red oaks is 2.2%, lower than the statewide average of 2.6% for all species.

For a table of **Average annual growth, mortality and removals by region** go to:
http://dnr.wi.gov/topic/ForestBusinesses/documents/tables/GrowthMortalityRemovals.pdf

*"How healthy are red oaks in Wisconsin?"*

**Average annual mortality: 1983, 1996, and 2012**

The average annual mortality of red oaks, about 26.3 million cft per year in 2012, has doubled since 1983 and increased 41% since 1996 (Chart 5). The percent of statewide mortality, 11.1%, is lower than the percent of total volume in the state, 12.4%.

The ratio of mortality to gross growth is 31.1% for red oak species, almost equal to the statewide average of 28.8% (Table 3).

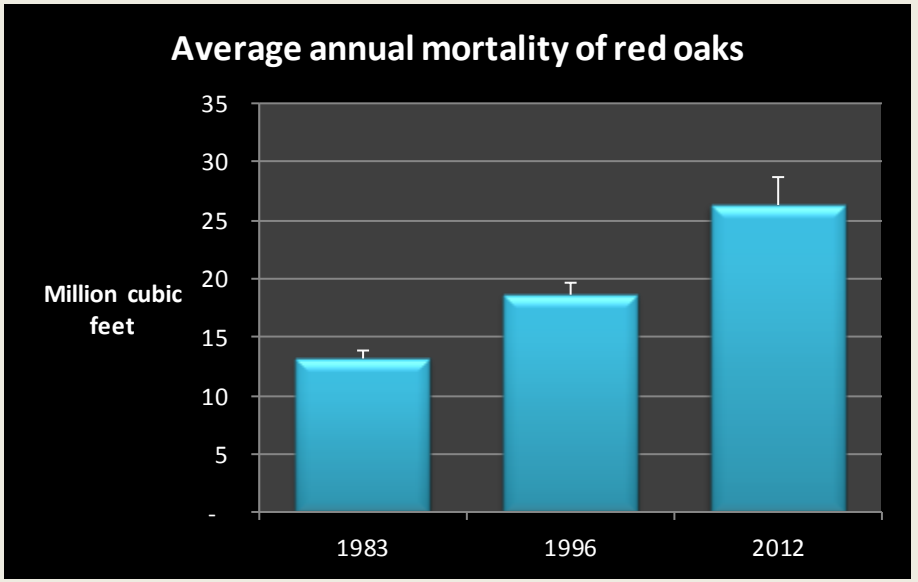



Chart 5. Average annual mortality (million cubic feet) by inventory year.
Source: USDA Forest Inventory & Analysis data: 1983, 1996, and 2012

Table 3. Mortality, gross growth, and the ratio of mortality to gross growth.

| Species | Average annual mortality (cft) | Average annual gross growth (cft) | Mortality / growth |
|---|---|---|---|
| **Black oak** | 8,791,832 | 11,474,762 | **76.6%** |
| **Northern pin oak** | 8,402,492 | 15,722,920 | **53.4%** |
| **Northern red oak** | 9,096,528 | 57,459,504 | **15.8%** |
| **Total red oaks** | **26,290,851** | **84,657,186** | **31.1%** |

Source: USDA Forest Inventory & Analysis data: 2012

For a table of **Average annual growth, mortality and removals by region** go to:
http://dnr.wi.gov/topic/ForestBusinesses/documents/tables/GrowthMortalityRemovals.pdf

*"How much red oak do we harvest?"*

## Roundwood production by product and year

In 2009, Wisconsin produced 59.2 million cft of red oak roundwood or about 16% of the state's total volume (Chart 6). The red oaks are the third most productive species group after aspen and hard maple. About 20% was in pulpwood, 23% in sawlogs and 57% in fuelwood.

Between 2003 and 2009, pulpwood and sawlog production decreased but fuelwood production doubled. Red oaks now make up 40% of total fuelwood in the state.

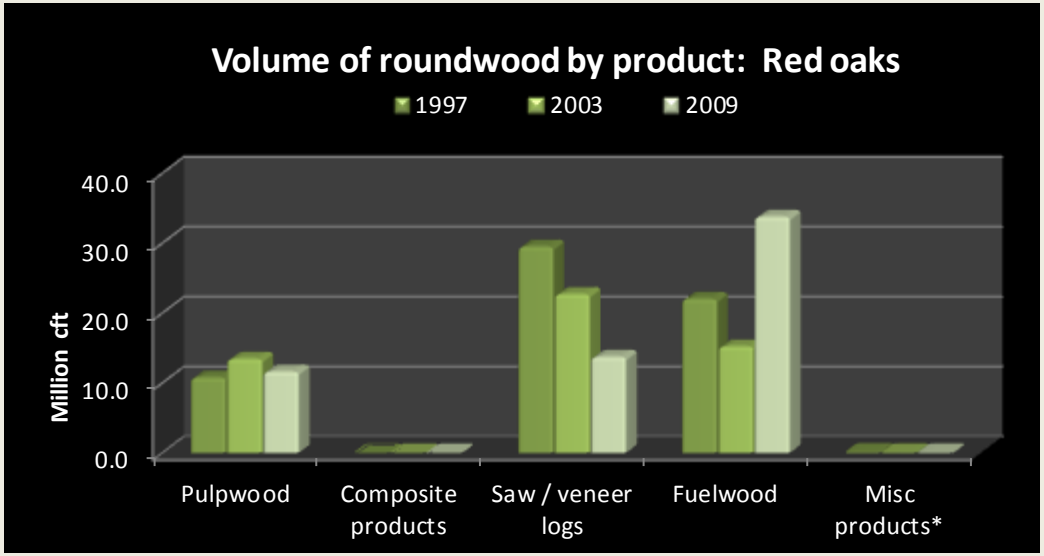



Chart 6. Volume of roundwood products. * Miscellaneous products include poles, posts, and pilings.
Source: Ronald Piva, USDA Forest Service, Northern Research Station, St. Paul MN

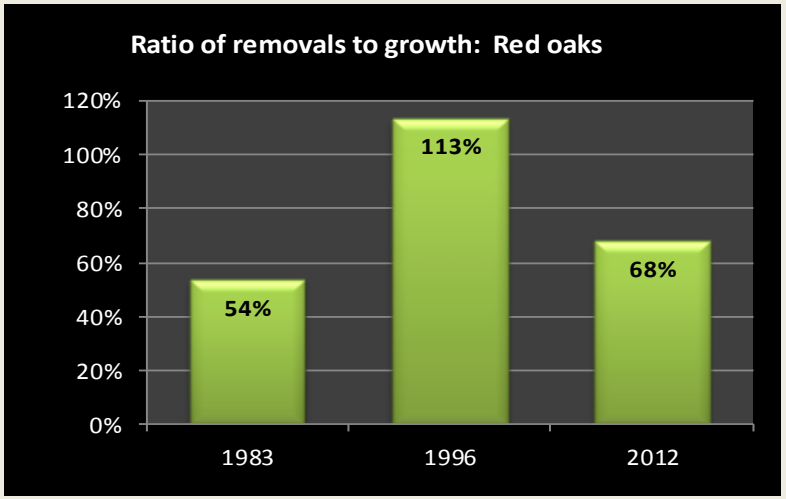



Chart 7. Ratio of volume harvested annually to net growth.
Source: USDA Forest Inventory & Analysis data: 1983, 1996, and 2012.

Removals of red oak were 39.6 million cft per year from 2008 to 2012 and 63% of this was Northern red oak.

The ratio of removals to growth appears to have peaked in 1996 and then decreased (Chart 7),due to a 38% decrease in removals combined with a 4% increase in growth since 1996. The ratio of removals to growth for red oaks was 68% in 2012, higher than the average of 53.4% for all species in the state.

For a table of **Average annual growth, mortality and removals by region** go to:
http://dnr.wi.gov/topic/ForestBusinesses/documents/tables/GrowthMortalityRemovals.pdf

*"How much is red oak selling for?"*

## Prices for cordwood & sawtimber: 2000 to present

**D**ue to the variability of timber prices from year to year and region to region, two methods of reporting prices are presented here: Timber Mart North and weighted average stumpage prices from Wisconsin Administrative Code Chapter NR 46.

**S**tumpage and delivered prices for sawtimber, as reported in the Timber Mart North (Chart 8), have been decreasing since 2000. Log prices are currently much higher than average for hardwoods.

**A**verage weighted values for cordwood and logs as reported in NR46 (Table 4), have fallen from a peak in 2003. Log prices are currently much higher than the average price for hardwood logs.

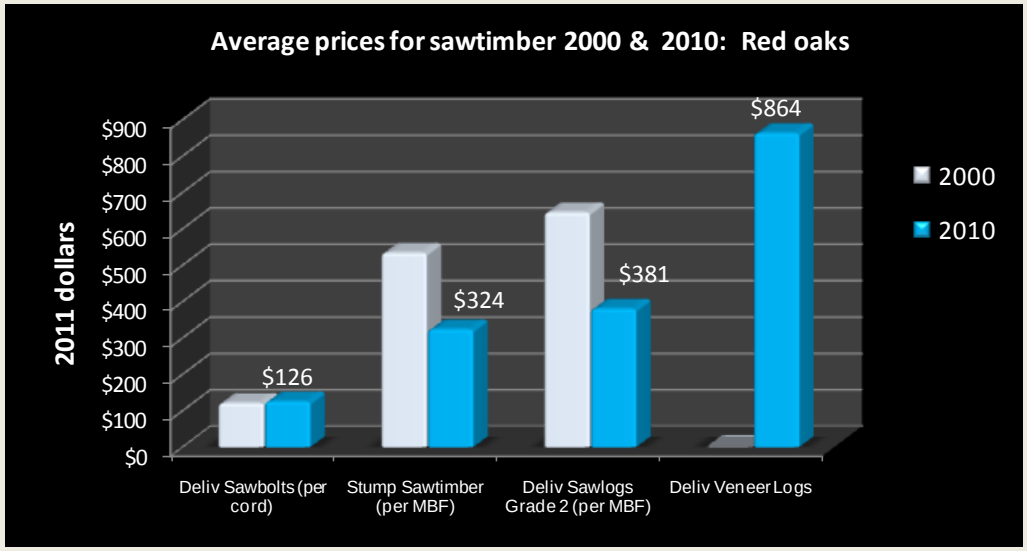
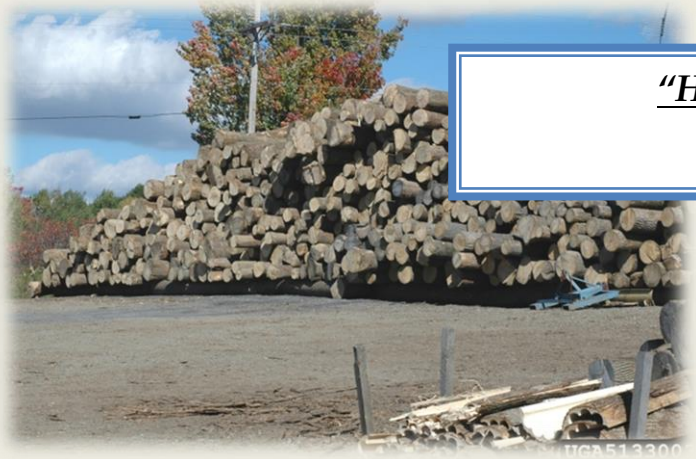



Chart 8. Average prices for cordwood and sawtimber (2008).
Source: Timber Mart North, George Banzhaf & Company, 8301 N. Allen Lane, Milwaukee, WI 53217

Table 4. Average weighted stumpage prices (adjusted for inflation to 2012 dollars) by year for Wisconsin.

| Product | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 2012 | Average for all hardwoods |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Cordwood (per cord)** | $19 | $27 | $21 | $26 | $22 | $21 | NA | $21 | $21 | **$18** | $19 |
| **Logs (per MBF scribner)** | $441 | $536 | $517 | $499 | $436 | $359 | $359 | $281 | $274 | **$254** | $148 |

Source: Wisconsin Administrative Code Chapter NR46, 2002 to 2012. The stumpage values calculated each year are for the sole purpose of assessing MFL yield and FCL severance taxes, not for determining the price that should be received for timber.



## *"How much red oak biomass do we have?"*

**Oven-dry tons by region of the state**

There were 93.9 million short tons of aboveground biomass in live trees in the red oak group in 2012, an increase of 18% from 1983. This is equivalent to approximately 46.7 million tons of carbon and represents 15% of all aboveground carbon statewide. As with volume, most of the ash is located in central Wisconsin (Chart 9).

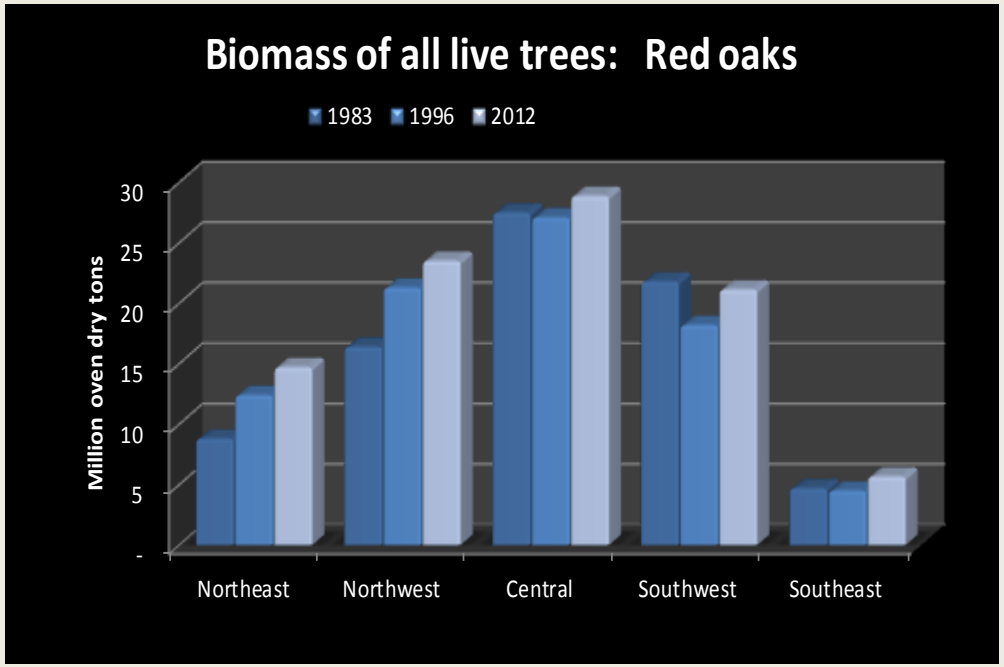



Chart 9. Biomass (above ground dry weight of live trees >1 in dbh, short tons) by year and region of the state.
Source: USDA Forest Inventory & Analysis data: 1983, 1996, and 2012

The density of red oak wood is the highest of all species with a ratio of biomass to volume of 59.3 oven-dry lbs. per cubic foot (ODP/cft). The average for all hardtwoods is about 50.1 ODP/cft and for all species is 46.8 ODP/cft. Approximately, 77% of all red oak biomass is located in the main stem and 19% in the top branches.

The high volume of red oaks combined with the high density of red oak wood may make it a valuable species for biomass production.

For a table of **Biomass by County for 2012** go to:
http://dnr.wi.gov/topic/ForestBusinesses/documents/tables/BiomassByCounty.pdf